CURRENT KNOWLEDGE OF BRITISH ACULEATE HYMENOPTERA WITH SPECIAL REFERENCE TO THE OCCURRENCE OF HIGH QUALITY SPECIES ON PRIORITY HABITATS

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ABSTRACT

An account is given of British aculeate species and their habits based on current and historical information. Excluding the Dryinidae, Embolemidae, Bethylidae species, there are 573 species currently on the British list of which 29 species are only found in the Channel Islands and 40 species are probably now extinct in England, Wales and Scotland. The British species are divided into High Quality species with Very Rare, Rare or Scarce statuses and Low Quality Species with Restricted, Widespread or Universal statuses. Current Priority Species are also considered. The Priority Habitats of the High Quality species are tabled and it is found that five habitats (Lowland Heathland, Maritime Cliffs and Slopes, Lowland Calcareous Grassland, Coastal Sand Dunes and Lowland Dry Acid Grassland) are particularly important. The non-Priority Habitat, Post-industrial Sites, is of equal importance. Dividing the solitary species into parasitic and non-parasitic species it is found that the parasitic High Priority Species are the most threatened group of species. Concerning nest-site characteristics, the solitary wasp species are particularly associated with aerial sites and the solitary bee species with subterranean sites. Adults of the solitary wasp species are mainly summer species while adults of the solitary bees vary from being early spring to autumn species. The food requirements of the aculeates are considered as well as monitoring methods for single species and species assemblages. Finally, examples of good and bad management of aculeate species are reviewed.

INTRODUCTION

In this paper an attempt is made to summarise current information of British aculeate Hymenoptera (excluding Ireland and the Channel Islands) in an historical context. Excluding vagrant and extinct species, the distribution and abundance of each species will be used to assign each species a status so that the rare and scarce or High Quality species can be recognised. The High Quality species will then be associated with Priority and non-Priority habitats in order to find those specialist species which are restricted to one Priority Habitat.

Quick reviews are given of parasitic and non-parasitic species, nest-site characteristics, adult activity patterns and food resources. Finally, monitoring methods and good and bad management practices will be considered.

Reference should be made to Else (2004) for authority of species and their synonyms.

HISTORICAL AND CURRENT SOURCES OF INFORMATION

There is a strong tradition in publishing national and county reports of the aculeate Hymenoptera from the nineteenth century onwards. Nationally, early accounts of bees are given by Kirby (1802) and Shuckard (1866) and of wasps by

Shuckard (1837). Smith (1855, 1858) gives an account of the wasps, ants and bees often including species information on abundance, nest-site characteristics and habitats in which found. Saunders (1896) extends the work of Smith with species information on distribution, abundance, adult activity, habitat, nest-site characteristics, flowers visited, prey collected and some attempt to associate cleptoparasites with their hosts. None of these accounts considered the Chrysididae. In the check list of Yarrow (1943) all aculeates, including the Chrysididae, are considered with brief information on adult flight period, nest-site characteristics, food sources and host-parasite associations.

County reports started with Bold (1870) on Northumberland and Durham, Bridgman (1879) on Norfolk and Morley (1899) on Suffolk. Early accounts of part of a county are given by Dale & Dale (in Spooner, 1942) of Glanvilles Wotton in Dorset, Harwood (1884) of Colchester in Essex and Perkins (1892) of Wootton-under-Edge in Gloucestershire. Perkins' account is particularly readable because of the introductory notes on each of the taxonomic groups of aculeates. From the start of the twentieth century the aculeates, often including the Chrysididae, were considered in the Victoria County History Reports, e.g. Kerrich (1938) on Cambridgeshire and Richards (1939) on Oxfordshire and other county reports, e.g. Perkins (1923) on Devon and Chambers (1949) on Bedfordshire. The accounts of Kerrick and Richards give much species information: sites where recorded with dates, names of recorders, habitats used, nest-site characteristics, prey collected, hosts of cleptoparasites and flowers visited. The account of Chambers compares the species assemblages of different regions of Bedfordshire based on surface geology anticipating the later development of Natural Areas. During the 1990s and 2000s, county reports started to include species distribution maps, e.g. Baldock & Collins (1999) on Surrey, Harvey (1999) on Essex, Allen (2001) on Kent and Archer (2002) on Yorkshire. The accounts of Harvey and Archer also consider the conservation needs of species.

In recent times the conservation of aculeates has been a driver in the assembling of species information. Shirt (1987) with the help of G.R. Else and G.M. Spooner considered that 37 species were Endangered (Red Data Book 1 species, in danger of extinction), 12 species were Vulnerable (Red Data Book 2 species, likely to become endangered in the near future) and 97 species were Rare (Red Data Book 3 species, at risk as found in, at most, 15 10-km squares). At least eight of the Endangered species were believed to be extinct and a further 18 species were extinct before 1900. Species data given were: habitats, food sources, adult activity, probability of extinction, threats and nest-site characteristics.

Falk (1991) reviewed the RDB species plus a new category of Nationally Notable (now called Scarce) Species. These Nationally Scarce species were divided into a List A of species found in 16–30 10-km squares from 1970 onwards and List B of species found in 31–100 10-km squares from 1970 onwards. A great deal of species information was provided, supported by extensive literature references. Species information given was: distribution; habitat; ecology including nest-site characteristics, food resources, adult activity and host-cleptoparasite relationships; status (including proposed status changes of Red Data Book species); threats and management.

From 1997, the Bees, Wasps and Ants Recording Society (BWARS) has issued provisional atlases of the British and Irish aculeates including the Channel Islands. To date five parts have been published (1997, 1998, 2001, 2002, 2005) dealing with 282 species plus one species of the Embolemidae and two species of the Bethylidae and with 302 species yet to be considered. The atlases include a map for each species

together with a profile of the information available, including its overseas distribution.

The UK Biodiversity Steering Group (1995) stated the need to take conservation measures for key habitats and species. Some of these species and habitats were later called Priority Habitats and Species and became the basis of the UK Biodiversity Action Plan. Priority Species are British species which are globally threatened or which are rapidly declining in the UK (www.ukbap.uk/species.aspx). Priority Habitats are British habitats, for which the UK has international obligations, or are at risk due to their recent decline or rarity, or are important for BAP species (www.ukbap.uk/habitats.aspx).

Finally, Archer (2005) wrote a report available on a CD from Buglife (The Invertebrate Conservation Trust) where the rare and scarce species, including the Priority Species (but excluding the Dryinidae, Embolemidae and Bethylidae species) are grouped by Priority Habitats. This report is concerned with managing Priority Habitats for aculeates and extensive use is made of Falk (1991) and the Provisional Atlases of BWARS. The following species information is considered: habitat management techniques, if a Priority Habitat specialist, subhabitat preferences, feeding preferences, monitoring techniques based on current information and examples of good and bad management.

British and Irish list of species

Excluding the Dryinidae, Embolemidae and Bethylidae, there are 573 aculeate species currently on the British and Irish list (Else, 2004). The distribution of these species is given in Table 1. Twenty-nine species are only found in the Channel Islands while 40 species are now probably extinct in England, Wales and Scotland (Table 2). Probably 16 of these extinct species were only vagrants. Of course, it is difficult in some cases to decide whether a species is extinct or waiting to be re-discovered. Recently *Halictus eurygnathus* Blüthgen was re-discovered on Sussex downland after 45 years (Falk, 2004). Nine of these extinct species can still be found on the Channel Islands. With the removal of the extinct and Channel Islands only species, 504 (423 solitary, 81 social) species are found in England, Wales and Scotland (i.e. Britain) including Ireland. No further reference will be made to species found in Ireland due to the lack of data.

There is a similar number of solitary wasp and bee species while the social species represent 16% of all species.

Species statuses

Although all species are of conservation value it must be recognised that some species are more in need of help than other species, the so-called 'species of conservation concern'. As already indicated, such species have been given statuses such as RDB and Nationally Scarce Species, Priority Species and the new IUCN statuses (IUCN, 1994) which have not yet been applied to the aculeates.

In order to react quickly to changes in species statuses as a result of new information, Archer (1999, 2002) divided the British aculeate species into six status categories. The 'species of conservation concern' were called 'High Quality species' and each species was given a 'Very Rare', 'Rare' or 'Scarce' status. The remaining species were called 'Low Quality species' and each species given a 'Restricted', 'Widespread' or 'Universal' status. These statuses are published and kept up-to-date in the Newsletters of the BWARS. The statuses of the High Quality Species are based

Table 1. The distribution of the aculeate Hymenoptera of the British Isles

Taxonomic Group	Channel Islands only	Extinct on Mainland (Britain)	Channel Islands Still with extinct (British) species	Mainland (British)	Total Species
Solitary Wasps					
Chrysididae	2	1	1	30	33
Tiphiidae	0	0	0	3	3
Mutillidae	0	0	0	3	3
Sapygidae	0	0	0	2	2
Scoliidae	1	0	0	0	1
Pompilidae	3	2	1	39	44
Eumeninae	1	3	1	20	24
Sphecidae	3	0	0	4	7
Crabronidae	3	8	2	112	123
Total Solitary Wasps	13	14	5	213	240
Solitary Bees					
Colletinae	0	1	0	20	21
Andreninae	1	7	0	62	70
Halictinae	4	6	1	50	60
Melittinae	0	0	0	6	6
Megachilinae	2	5	2	33	40
Anthophorinae	4	1	0	38	43
Xylocopinae	0	1	0	1	2
Total Solitary Bees	11	21	3	210	242
Social Species					
Formicidae	5	1	1	48	54
Vespinae	0	1	0	9	10
Apinae	0	3	0	24	27
Total Social Species	5	5	1	81	91
Total Species	29	40	9	504	573

on the occurrence of a species in the number of 10-km squares from 1970 onwards in England, Wales and Scotland but not Ireland and The Channel Islands. Very Rare species (equivalent to RDB species) are found in 1–15 10-km squares, Rare species (equivalent to Nationally Scarce Species list A) in 16–30 10-km squares and Scarce species (equivalent to Nationally Scarce Species list B) in 31–70 10-km squares. The divider of 70-km squares was used instead of the 100-km squares of Falk (1991) because as the numerical data became available the divider at 70-km squares better reflected Falk's concept of National Scarce List B which was really derived from qualitative data. The Priority species usually have a Very Rare status. The statuses of the Low Quality Species are based on their distribution in England, Wales and Scotland when found in more than 70 10-km squares from 1970 onwards. Restricted species are found in the Institute of Terrestrial Ecology (I.T.E.) Land Classification groups 1 and 2 (Pienkowski *et al.*, 1996) (Southern England, South-West and Southern Coasts of England) which is roughly about half of England. Widespread species extend into I.T.E Land Classification groups 3 and 4 (Midlands Lowlands and Central Coasts) which is roughly about three-quarters of England, lowland Wales and south-west Scotland with Northumbria excluded. Strictly these definitions

Table 2. Extinct and vagrant (V) species of England, Wales and Scotland.

Hedychrum rutilans Dahlbom	*Andrena nanula* Nylander (V?)
Formica pratensis Retzius	*Andrena polita* Smith
Priocnemis propinqua (Lepeletier) (V?)	*Andrena tridentata* (Kirby)
Arachnospila rufa (Haupt)	*Andrena vaga* Panzer (V?)
Eumenes papillarius (Christ) (V)	*Halictus maculatus* Smith
Odynerus reniformis (Gmelin *in* L.)	*Halictus subauratus* (Rossi) (V?)
Ancistrocerus quadratus (Panzer)	*Lasioglossum laeve* (Kirby)
Polistes dominulus (Christ) (V?)	*Rophites quinquespinosus* Spinola (V?)
Dinetus pictus (Fab.) (V?)	*Dufourea halictula* (Nylander)
Tachysphex obscuripennis (Schenck)	*Dufourea minuta* Lepeletier
Crossocerus congener (Dahlbom) (V?)*	*Osmia niveata* (Fab.) (V)
Lestica clypeata (Schreber) (V?)	*Hoplitis leucomelana* (Kirby) (V?)
Lindenius pygmaeus (Rossi) (V?)	*Chalicodoma ericetorum* (Lepeletier)
Psen ater (Olivier)	*Megachile lapponica* Thomson (V?)
Mellinus crabroneus (Thunberg)	*Coelioxys afra* Lepeletier
Cerceris sabulosa (Panzer)	*Melecta luctuosa* (Scopoli)
Hylaeus punctulatissimus Smith	*Xylocopa violacea* (L.) (V)
Andrena floricola Eversmann (V)	*Bombus cullumanus* (Kirby)
Andrena lepida Schenck	*Bombus pomorum* (Panzer) (V)
Andrena nana (Kirby)	*Bombus subterraneus* (L.)

*See Acknowledgments and Caution Statement

of Restricted and Widespread species are for southern Restricted and Widespread species. In practice, northern Restricted and Widespread species can occur. Universal species are found throughout England, Wales and Scotland, including I.T.E. Land Classification groups 5 and 6 (Low Moorlands and Northern Uplands), but particularly groups 7 and 8 (Northern Lowlands and North-western Seaboard).

The use of 1970 as the divider year is unsatisfactory and a more recent year would be preferred. Except for the Priority Species, data for other species are generally only available using the 1970 divider, so this year must be used. Nevertheless, information has been used from the BWARS Newsletters so that recent changes in species statuses can be incorporated into the Archer statuses, e.g. *Philanthus triangulum* (Fab.) is no longer regarded as a High Quality Species.

Application of the new IUCN status definitions should bring about further changes in statuses of species of conservation concern particularly with the use of more recent information.

The Archer national statuses can be applied to the solitary species but probably only with caution to the social species. A colony or nest of a social species is not really the equivalent of a nest of a solitary species since there are many more individuals (hundreds to thousands) associated with a nest of a social species than a nest of solitary species. A few solitary bee species are communal species in that the females use a common entrance but provision their cells or nest independent of each other. A few "solitary" bee species of the genus *Lasioglossum* are really social species but the number of workers per colony are very few, usually less than ten. As such, the social species may be more readily found and could be given a lower status than is perhaps appropriate.

Table 3 shows the distribution of the British solitary species among the six statuses. Among the Low Quality species there are a similar number of Universal and Widespread species but fewer Restricted species. Among the High Quality species there are a similar number of Scarce and Very Rare species but fewer Rare species.

Table 3. The statuses of the British solitary wasps and bees.

Taxonomic Group	Universal	Widespread	Restricted	Scarce	Rare	Very Rare	Priority Species
Solitary Wasps							
Chrysididae	6	4	0	10	4	6	2
Tiphiidae	0	1	0	2	0	0	0
Mutillidae	0	1	0	2	0	0	0
Sapygidae	0	1	0	1	0	0	0
Pompilidae	11	6	0	10	6	6	2
Eumeninae	7	3	0	3	1	6	1
Sphecidae	0	1	0	2	1	0	0
Crabronidae	32	28	8	15	9	20	2
Total Solitary Wasps	56	45	8	45	21	38	7
Solitary Bees							
Colletinae	3	5	1	4	2	5	1
Andreninae	17	13	3	12	7	10	3
Halictinae	11	14	4	8	3	10	1
Melittinae	0	1	0	4	0	1	0
Megachilinae	6	10	2	4	2	9	4
Anthophorinae	8	8	3	3	8	8	3
Xylocopinae	0	0	0	0	1	0	0
Total Solitary Bees	45	51	13	35	23	43	12

Nearly half (48.5%) of the species are High Quality species. These are species that are at risk, or could become at risk, and need particular consideration for conservation. This percentage is similar to that for butterflies (Asher *et al.*, 2001) and perhaps is more serious as more species of aculeates than butterflies are involved.

Table 3 also shows the current distribution of Priority species among the solitary species. In addition, at present, there are eight ant Priority species and four bumblebee Priority species.

High Quality solitary species can have Universal, Widespread and Restricted distributions. The Restricted distribution is characteristic of the Very Rare (84.0%) and Rare (65.9%) species while the Scarce species mainly have a Widespread (52.5%) and Restricted (40.0%) distribution. The Universal distribution is shown by the Very Rare species *Pemphredon rugifera* (Dahlbom), the Rare species *Ceropales maculata* (Fab.) and *Lasioglossum quadrinotatum* (Kirby), and the Scarce species *Mutilla europaea* L., *Anoplius concinnus* (Dahlbom), *Crossocerus palmipes* (L.), *C. walkeri* (Shuckard), *Andrena nigriceps* (Kirby) and *Sphecodes ferruginatus* von Hagens.

The High Quality solitary species with Widespread and Restricted distributions are usually southern English species. The exceptions are the Restricted northern species *Chrysura hirsuta* (Gerstäcker), *Osmia inermis* (Zetterstedt) and *O. uncinata* Gerstäcker; the Widespread northern species *Crossocerus leucostomus* (L.), *Passaloecus monilicornis* Dahlbom, *Andrena ruficrus* Nylander and *Osmia parietina* Curtis; the Widespread coastal species *Colletes halophilus* Verhoeff and *C. marginatus* Smith; the Widespread western coastal species *Minumesa littoralis* (Bondroit) and *Colletes cunicularia* (L.); the Widespread north-west coastal species *Colletes floralis* Eversmann; and the Widespread southern and western species *Andrena apicata* Smith.

Of the social species, the social wasps (Vespinae) have six species with a Universal distribution and three species with a Widespread distribution. *Vespula austriaca* (Panzer) has a Widespread distribution in northern and western Britain. For the bumblebees and honeybee (Apinae) there are 15 species with a Universal distribution, five species with a Widespread distribution and four species with a Restricted distribution. *Bombus distinguendus* Morawitz has a Restricted distribution in north-western Scotland. Both *Bombus monticola* Smith and *B. magnus* Vogt have Widespread distributions in north-western Britain.

The study of the distribution of the ants (Formicidae) is not yet complete particularly because of the recent discoveries of new species of *Myrmica* and *Lasius*. As a first approximation there are eleven species with Universal distributions, ten species with Widespread distributions, 24 species with Restricted distributions and two species, *Formica exsecta* Nylander and *F. sanguinea* Latreille with disjunct populations in northern and southern Britain. *Formica aquilonia* Yarrow (Restricted distribution) and *F. lugubris* Zetterstedt (Widespread distribution) are found in northern Britain while *F. lemani* Bondroit (Widespread distribution) is found in northern and western Britain.

Habitats of the high quality species

The UK Biodiversity Action Plan has divided habitats into 28 Broad Habitats in which are 45 Priority Habitats (http://www.ukbap.org.uk/habitats.aspx). The Broad Habitats are meant to be comprehensive as the following four Broad Habitats illustrate.

1. Boundary and Linear Features – includes hedgerows, walls, dry ditches, roads and railways with associated semi-natural habitat.
2. Arable and Horticultural – includes perennial woody crops and intensively managed orchards, commercial horticultural land, freshly ploughed land, annual leys, rotational set-aside and fallow.
3. Inland Rock – includes natural and artificial exposed rock surface almost lacking in vegetation, as well as various forms of excavations and waste tips. It also includes inland cliffs, ledges, caves, screes, limestone pavement, quarries and quarry waste.
4. Built-up areas and Gardens – includes urban and rural settlements, farm buildings, caravan parks, other man-made structures including industrial estates, retail parks, waste and derelict ground, urban parkland, transport infrastructure, gardens and allotments.

These four Broad Habitats have no Priority Habitats except for Limestone Pavement. However, some of them can be very important for aculeates, e.g. Post-industrial sites.

Besides the 205 High Quality solitary species, a further 19 ant (eight Priority species and six treated as Very Rare, two Rare and three Scarce species) and eight bumblebee (four Priority species and four treated as Scarce species) species (i.e. total 232 species), will be considered in allocating species to Priority Habitats. Because of the difficulty of separating the ant species *Tapinoma ambiguum* Emery and *T. erraticum* (Latreille), these two species will be considered together in any further analysis (Edwards & Telfer, 2001: 28). The Priority ant species are listed on the web site: http://ukbap.org.uk/ants.htm and the wasps and bees on the web site: http://ukbap.org.uk/SpeciesGroup.aspx?ID = 5.

Problems with four groups of species were encountered in trying to associate High Quality Species with Priority Habitats: aerial-nesting species with their aculeate parasites, species of non-Priority woodland, bumblebee species requiring open flowery habitats and species for which there is insufficient information.

Ten aerial-nesting species and their aculeate parasites could not be associated with any Priority Habitat. Three parasite species (*Omalus aeneus* (Fab.), *O. puncticollis* (Mocsáry), *Pseudomalus violaceus* (Scopoli)) are associated with dead wood nesting hosts which are often common and widespread species found in many open habitats. There is little information about four Very Rare species (*Chrysis longulus* Abeille de Perrin, *C. pseudobrevitarsis* Linsenmaier, *Nitela borealis* Valkeila, *N. lucens* Gayubo & Felton) except that they are found in a variety of open habitats. The remaining three species (*Gymnomerus laevipes* (Shuckard), *Ectemnius dives* (Lepeletier & Brullé) and *Stigmus pendulus* Panzer) at present can only be associated with open habitats.

Five species (*Priocnemis cordivalvata* Haupt, *P. susterai* Haupt, *Passaloecus eremita* Kohl, *Andrena congruens* Schmiedeknecht and *Nomada obtusifrons* Nylander) can only be associated with open areas in non-Priority woodland which by coincidence may be within in other Priority non-woodland Habitats. *Passaloecus eremita* is associated with pine trees but since it is, at present, restricted to south-eastern England it cannot be associated with Native Pine Woodland.

Bumblebee species require extensive long-lasting open flower-rich areas with some coarse vegetation areas for nesting either under leaf-litter or in small mammal burrows. In practice, the eight bumblebee species are associated with Priority Habitats although often with a large number of such Habitats.

For five species [*Philoctetes truncatus* (Dahlbom), *Chrysis schencki* Linsenmaier, *Anoplius concinnus* (Dahlbom), *Trypoxylon minus* de Beaumont, *Eucera nigrescens* Pérez] there is insufficient information to associate them with any Priority Habitat.

Subtracting these 20 species from the 232 species for consideration, 212 species are left to be associated with Priority and non-Priority Habitats. These 212 species can be associated with 22 Priority Habitats (Table 4) which are found in 16 Broad Habitats. Although Table 4 is a summary of current information it is unlikely to be complete. It is likely that more species will be associated with Lowland Dry Acid Grassland, Ancient and/or species-rich Hedgerows and Lowland Wood-Pastures and Parkland.

Five of the Priority Habitats (Major Priority Habitats) are particularly important for the High Priority Species. These are, in order of their importance with the percentage of considered species in brackets: Lowland Heathland (61.3%), Maritime Cliffs and Slopes (32.1%), Lowland Calcareous Grassland (26.9%), Coastal Sand Dunes (26.4%) and Lowland Dry Acid Grassland (14.6%). Harvey (pers. comm.) has made available a list of RDB and Nationally Scarce Species of Brownfield Sites. This list of 88 species including three Priority Species, equates, at least, for some Brownfield sites with the Major Priority Habitats for aculeates. Such Brownfield sites, known as Post-industrial sites, are now being considered as a potential Priority Habitat (Bodsworth *et al.*, 2005; Tucker *et al.*, 2005).

The other Priority Habitats (Minor Priority Habitats) have only 1–12 species associated with them. For the following, only one High Quality species can be associated with one Priority Habitat: *Crossocerus walkeri* (Shuckard) with Chalk Rivers, *Osmia parietina* with Limestone Pavement, *Bombus ruderatus* (Fab.) with Lowland Meadows, *Formica candida* Smith with Lowland Bog and *Pemphredon morio* Vander Linden with Wet Woodland. With the exception of *Crossocerus walkeri*, these species can be associated with two to four Priority Habitats. *Crossocerus walkeri* is associated with high quality water from which it obtains its

Table 4. The association of High Quality species with their Priority Habitats.

Priority Habitats	Priority Species	Very Rare Species	Rare Species	Scarce Species	Total Species
Ancient/Species-Rich hedgerows	0	3	0	3	6
Cereal Field Margins	1	1	0	5	7
Chalk Rivers	0	0	0	1	1
Coastal Flood Plains & Grazing Marsh	1	1	1	1	4
Coastal Saltmarsh	2	0	1	3	6
Coastal Sand Dunes	4	13	12	27	56
Coastal Vegetated Shingle	5	2	1	1	9
Fen	0	4	3	3	10
Limestone Pavement	1	0	0	0	1
Lowland Calcareous Grassland	6	15	13	23	57
Lowland Dry Acid Grassland	4	8	4	15	31
Lowland Heathland	12	33	32	53	130
Lowland Meadow	1	0	0	0	1
Lowland Raised Bog	1	0	0	0	1
Lowland Wood Pasture & Parkland	0	3	3	6	12
Machair	1	0	0	1	2
Maritime Cliff & Slopes	5	21	13	29	68
Native Pine Woodland	7	0	0	0	7
Reedbeds	0	3	2	1	6
Upland Calcareous Grassland	3	0	0	0	3
Upland Heathland	0	1	1	3	5
Wet Woodland	0	0	0	1	1

prey of mayflies. As such, it could be associated with other high quality waters. It nests in dead wood which is found in open areas and presumably near to its prey source.

There is very little evidence associating High Quality species with Ancient/species-rich Hedgerows, Cereal Field Margins and Lowland Wood-Pasture and Parkland which indicates that more recording needs to be carried out in these habitats.

Another problem in associating a High Quality species with a Priority Habitat is that the literature often only refers to the micro-habitats in which the species find its resources that it needs. These six resources are nesting, foraging, overwintering, sunning and mating sites and building materials. If only information about micro-habitat information is available some interpretation was necessary in associating a species with a Priority Habitat.

In general terms, the usual characteristics of Priority Habitats for High Quality Species are terrestrial, lowland and open habitats. Exceptions are for Fen (*Odynerus simillimus* Morawitz, *Macropis europaea* Warncke), Reedbeds (*Passaloecus clypealis* Faester, *Hylaeus pectoralis* Förster), Upland Calcareous Grassland (*Chrysura hirsuta, Osmia inermis*) and Upland Heathland (*Mutilla europaea, Bombus monticola*). *Mutilla europaea* is also associated with Lowland Heathland.

A habitat specialist is a species which finds all its resources in one habitat. Such habitat specialists could be used as indicators of their habitats. Table 5 shows the number of Priority, Very Rare, Rare and Scarce species that are associated with one or more Priority Habitats. As noted previously some High Quality species cannot be associated with a Priority Habitat. Table 5 also shows whether species associated with one Priority Habitat are also associated with non-Priority Habitats. Thus of the

Table 5. Habitat associations of the High Quality species

Species Group	One Priority Habitat Only	One Priority & Non-Priority Habitats	More than One Priority Habitat	Not Placed
Priority	12	9	10	0
Very Rare	15	17	30	7
Rare	4	7	30	4
Scarce	4	17	57	9

species that can be associated with only one habitat (i.e. one Priority Habitat only), these include 12 Priority Species (37.8% of Priority species), 15 Very Rare species (24.2% of Very Rare species), four Rare species (9.8% of Rare species) and four Scarce species (5.1% of Scarce species). Generally, the rarer the species the more likely it is to be associated with one Priority Habitat. Table 6 lists the 35 High Quality Species with their sole associated Priority Habitat.

A limitation of specialist High Quality species being Indicator species is that often such species have a limited British distribution. Thus *Colletes halophilus* is restricted to the saltmarshes of south-east and eastern England, *C. floralis* to sand dunes of north-west England and western Scotland, *Melitta dimidiata* Morawitz to lowland calcareous grasslands of Salisbury Plain, *Chrysis fulgida* L. to lowland heathland of Surrey and Hampshire, *Lasioglossum angusticeps* (Perkins) to maritime slopes and cliffs of central southern England and *Osmia inermis* to upland calcareous grassland of Scottish Highlands. The four Scarce species are more widely distributed but are still restricted to south-east England and East Anglia.

Parasitic and non-parasitic species

The aculeate solitary species can be divided into those species that provide a food source for their offspring (non-parasitic species) and those species whose offspring either live off the food resource of their host species (cleptoparasites) or feed on the fully grown pre-adult stage of their host (parasitoids). Three species, *Tiphia femorata* Fab., *T. minuta* Vander Linden and *Methocha articulata* Latreille are parasitoids on non-aculeates and will not be further considered.

Although proportionally there are slightly fewer parasitic wasps (21.1% of solitary wasps) than parasitic bees (27.0% of solitary bees) parasitic and non-parasitic species are relatively equally distributed among the solitary bees and wasps ($2 \times 2\ \chi^2 = 2.04$, $P = 0.15$). However, parasitic species are relatively more likely to be High Quality species than Low Quality species ($2 \times 2\chi^2 = 6.53$, $P = 0.01$) indicating that High Quality parasitic species are the group of solitary species most at risk and threatened. Since there are 60 High Quality parasitic species there is a real problem in just monitoring these species.

Concerning the social species, eight species of social wasps (Vespinae) are non-parasitic and one species, *Vespula austriaca*, is an obligate social parasite of *V. rufa* (L.). Among the social bees (Apinae), 18 species are non-parasitic and six species are obligate social parasites, usually each species on one host species. Among the ants, 36 species are non-parasitic, five species are temporary social parasites, five species are obligate social species, one species (*Formica sanguinea*) is a facultative slave-maker

Table 6. Priority (P), Very Rare (VR), Rare (R) and Scarce (S) species restricted to only one Priority Habitat – the habitat specialists.

Priority Habitat	Associated species with status in brackets
Coastal Saltmarsh	*Colletes halophilus* Verhoeff (S)
Coastal Sand Dunes	*Evagetes pectinipes* (L.) (P), *Colletes floralis* Eversmann (P), *Myrmica specioides* Bondroit (VR), *Arachnospila consobrina* (Dahlbom) (VR), *Miscophus ater* Lepeletier (VR), *Colletes cunicularis* (L.) (VR), *Coelioxys mandibularis* Nylander (VR).
Lowland Calcareous Grassland	*Halictus eurygnathus* Blüthgen (VR), *Nomada armata* Herrich-Schäffer (P), *Melitta dimidiata* Morawitz (VR).
Lowland Dry Acid Grassland	*Miscophus bicolor* Jurine (VR).
Lowland Heathland	*Chrysis fulgida* L. (P), *Formica rufibarbis* Fab. (P), *Myrmica karavajevi* (Arnol'di) (VR), *Homonotus sanguinolentus* (Fab.) (P), *Pseudepipona herrichii* (de Saussure) (P), *Eumenes coarctatus* (L.) (S), *Ceropales variegatus* (Fab.) (VR), *Evagetes dubius* (Vander Linden) (R), *Mimumesa spooneri* (Richards) (VR), *Andrena argentata* Smith (R), *Andrena nigrospina* Thomson (R), *Lasioglossum sexnotatum* (Kirby) (VR), *Lasioglossum brevicorne* (Schenck) (S), *Lasioglossum prasinum* (Smith) (S), *Nomada baccata* Smith (R).
Maritime Cliffs	*Mimumesa atratina* (Morawitz) (VR), *Lasioglossum angusticeps* (Perkins) (P), *Lasioglossum laticeps* (Schenck) (VR), *Osmia xanthomelana* (Kirby) (P), *Nomada errans* Lepeletier (P), *Nomada conjungens* Herrich-Schäffer (VR).
Native Pine Woodland	*Osmia uncinata* Gerstäcker (P).
Upland Calcareous Grassland	*Osmia inermis* (Zetterstedt) (P).

and one species (*Formicoxenus nitidulus* (Nylander)) is a guest in the nest of another ant *Formica* species.

Nest-site characteristics

The nest-site characteristics of the non-parasitic species can be roughly divided into aerial and subterranean nesters. Aerial nesters use old beetle burrows in dead wood, central plant stem cavities, e.g. bramble, or exposed on the surface of rock or other hard surface, e.g. *Ancistrocerus oviventris* (Wesmael). Subterranean nesters can be further divided into true subterranean nesters, subterranean surface nesters and pompilid cavity nesters. True subterranean nesters nest in the soil usually in burrows dug by them. Subterranean surface nesters nest under stones, e.g. *Osmia inermis*, in snail shells, e.g. *Osmia aurulenta* (Panzer), *Hoplitis spinulosa* (Kirby), or in leaf litter, e.g. *Bombus pascuorum* (Scopoli). Pompilid subterranean cavity nesters nest in a variety of ready-made cavities including those under stones and in snail shells, e.g. *Anoplius nigerrimus* (Scopoli), or in the burrow of their spider prey, e.g. *Aporus unicolor* Spinola. Besides some pompilids, species of *Osmia* [e.g. *O. rufa* (L.)] and *Megachile* [e.g. *M. centuncularis* (L.)] are often cavity nesters using aerial, surface and subterranean sites. In these cases a species is allocated to the nesting site that is particularly characteristic of the species.

The nesting sites of solitary species are given in Table 7. The nesting characteristic of one species, *Mimumesa spooneri* (Richards), is unknown. The solitary wasp species

Table 7. Nest-site characteristics of solitary wasp and bee species.

	Aerial	Subterranean
Wasps	79	85
Bees	29	125
Low Quality Species	67	109
High Quality Species	41	101

are approximately equally divided between aerial and subterranean nesters, while 81% of solitary bee species are mainly subterranean nesters. A 2×2 χ^2-test shows not only the importance of subterranean nesting for the solitary bees (more subterranean nesters than expected by chance) but also the importance of aerial site nesting for the solitary wasps (more aerial nesters than expected by chance) ($\chi^2 = 30.5$, $P < 0.001$). The High and Low Quality Species are relatively equally likely to be aerial or subterranean nesters ($\chi^2 = 3.0$, $P = 0.09$).

The importance of aerial sites for solitary wasps is probably related to weather factors. Lomholdt (1975) showed that the aerial nesting frequency increased with increasing latitude for Sphecidae (28% in France and 79% in northern Norway). At higher latitudes average temperatures and amounts of sunshine would be reduced so that increasingly aerial sites are likely to warm up quicker and be warmer for a longer time than subterranean sites. The percentage of aerial-nesting British solitary wasps is 48% which is intermediate, as expected from its geographical position, for the above two localities. Archer (1990) found that the amount of activity of solitary wasps was more clearly related to summer weather than for summer solitary bees. The lower dependence of solitary bees on summer weather may partially explain their increased use of subterranean sites although other reasons for this preference need to be explored.

Concerning social wasps (Vespinae), four species are aerial nesters and three species are predominantly subterranean nesters. *Dolichovespula sylvestris* (Scopoli) often nests in earth cavities at or near soil surface although it frequently nests aerially in bird boxes. Among the social bees (Apinae), eight species are subterranean nesters, five species nest at the surface of the ground among leaf litter, two species are aerial nesters and three species, although mainly subterranean nesters, also use aerial sites. The ants (Formicidae) are mainly associated with the soil either nesting underground (five species), at the surface of the ground under cover, e.g. a stone, (15 species) or may nest underground or at the surface of the ground under cover (18 species). One species (*Leptothorax acervorum* (Fab.)) can nest underground or at the surface of the ground and three species (*Lasius brunneus* (Latreille), *L. fulginosus* (Latreille), *Temnothorax nylanderi* (Foerster)) are aerial nesters.

Adult activity

Figure 1 shows a plot of the number of species of solitary wasps and bees versus the months (March-October) in which they are active as adults. The solitary bees show a gradual increase in species numbers from March, reaching a maximum value during June, after which they gradually decrease. The solitary wasps, by way of contrast, delay their increase until May, reaching a maximum value during July, after which they decrease. The number of solitary wasp species is similar from June until

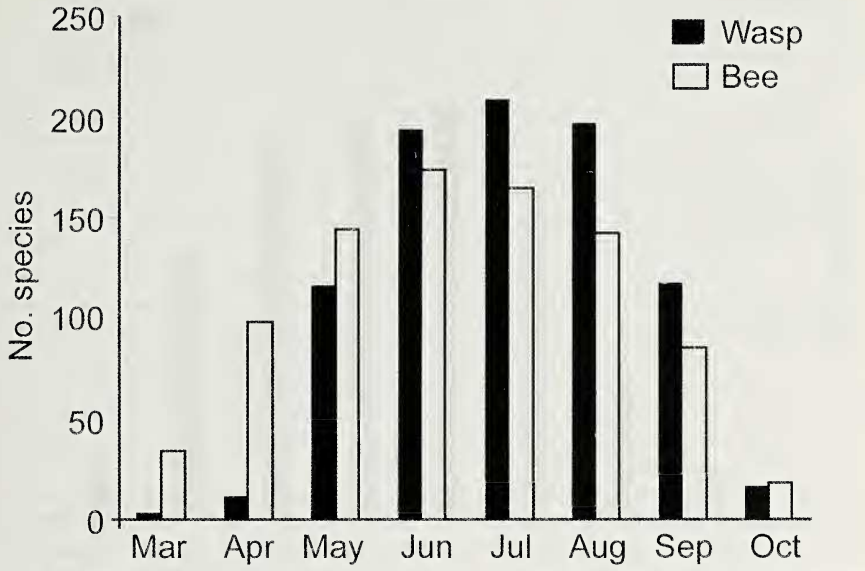

Fig. 1. The number of solitary wasp and bee species versus the months in which they are active as adults.

August while the number of solitary bee species is similar for an extra month, from May until August.

Most solitary wasp species, as already indicated, are summer species with a few species active during March or April, e.g. *Anoplius viaticus* (L.), *Priocnemis perturbator* (Harris), *P. coriacea* Dahlbom, *P. susterai* and several species of *Ancistrocerus*. In contrast, the solitary bee species can be early spring, spring, summer, late summer, autumn and double-brooded species. The adult activity of early spring species ends during April or May, e.g. *Colletes cunicularis, Andrena clarkella* (Kirby), *A. praecox* (Scopoli) and *A. ruficrus*. Spring species are active from April until June, e.g. *Andrena fucata* Smith, *A. fulva* (Müller *in* Allioni), *A. haemorrhoa* (Fab.), *A. synadelpha* Perkins, *Anthophora plumipes* (Pallas), *A. retusa* (L.) and the *Melecta* cleptoparasites of these *Anthophora* species. Like the solitary wasps, most solitary bees are summer species, typically being active from May until August, but may be present before and after these months, e.g., *Hylaeus, Andrena* (*A. tarsata* Nylander, *A. marginata* Fab., and *A. coitana* (Kirby)), *Panurgus, Dasypoda, Macropis,* Megachilinae and *Ceratina*. Late summer species are active from July or August until October, e.g. *Colletes succinctus* (L.), while autumn species are active during September and October, e.g. *Colletes hederae* Schmidt & Westrich. Double-brooded species include those species with a spring and summer brood, e.g. *Andrena bicolor* Fab. and *A. trimmerana* (Kirby), and those species with an overwintered fertilized spring female presence followed by a new generation of females and males, e.g. *Halictus, Lasioglossum* and their cleptoparasites, *Sphecodes* spp. *Andrena rosae* Panzer was previously considered a double-brooded species but its spring form is now given species status as *A. strangulata* Illiger. The cleptoparasitic *Nomada* are generally active during the same months as their hosts *Andrena*.

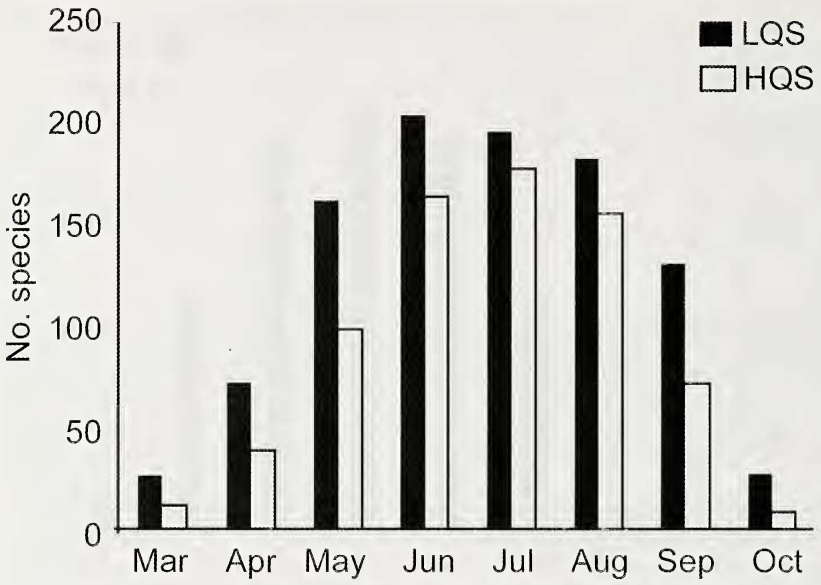

Fig. 2. The number of Low and High Quality Species versus the months in which they are active as adults.

Figure 2 shows a plot of the number of Low and High Quality species of solitary wasps and bees versus the months (March–October) in which they are active as adults. The Low Quality species are always more numerous than the High Quality species. This difference is not just a reflection of the greater number of Low Quality species (218 species) versus High Quality species (205 species) since the Low Quality species usually exceed the High Quality species by more than 13 species. Since High Quality species are rarer than Low Quality species they are less likely to be found so that the recorded months of adult activity are likely to be fewer.

Concerning the social species, the ants (Formicidae) have perennial colonies and the adults become active under favourable weather conditions. The sexuals are usually present and mate during July and August although a few species are earlier, during May or June, and a few later during September and October.

The social wasps (Vespinae) have an annual life cycle. The spring queens emerge from overwintering sites during March and April. Three species have long colony cycles with successful colonies usually terminating during October or early November while six species have short colony cycles usually terminating during August or early September. Most species of bumblebees (*Bombus*) have annual life cycles although *B. hortorum* (L.), *B. jonellus* (Kirby), *B. lucorum* (L.) and *B. pratorum* (L.) may be double brooded each year and *B. terrestris* (L.) may overwinter. Depending on the species, spring queens emerge during March, April or May and successful colonies terminate from August until November.

Food resources

The food resources are pollen for the bees, prey for the wasps and hosts for the parasitic species. In addition, all species need an energy food source which is often

nectar. These food resources can become critical to the existence of a species where a bee species limits its pollen source to one or a few related flower species (oligolectic bees), a wasp species only takes a limited number of prey species, a parasite species is dependent on a single host species and a bumblebee species with a long life cycle needs a continuous supply of pollen sources throughout its cycle.

Much more information is needed on food resources but already some information is available. For example, among the oligolectic solitary bees *Colletes cunicularis* obtains pollen from *Salix repens* L., *Hylaeus signatus* (Panzer) from *Reseda, Andrena florea* Fab. from *Bryonia dioica* Jacq., *Halictus eurygnathus* from *Centaurea scabiosa* L. and *C. nigra* L. and *Macropis europaea* Warncke from *Lysimachia vulgaris* L. Among the solitary wasp species *Homonotus sanguinolentus* (Fab.) preys upon the spider *Cheiracantheum erraticum* (Walckenaer), *Pseudepipona herrichii* (de Saussure) preys on larvae of the moth *Acleris hyemana* Haworth and *Crossocerus walkeri* preys on mayflies usually of the family Baetidae. Among the parasitic species *Hedychridium roseum* (Rossi) is dependent on *Astata boops* (Schrank), *Chrysis fulgida* on *Symmorphus crassicornis* (Panzer), *Anergates atratulus* (Schenck) on *Tetramorium caespituin* (L.), *Vespula austriaca* on *V. rufa* and *Bombus rupestris* (Fab.) on *B. lapidarius* (L.). Nisbet (2004) & MacDonald and Nisbet (2005) have found that *Bombus monticola* in the Central Highlands of Scotland is mainly dependent for pollen resource from *Vaccinium myrtillus* L. from April until mid-June, followed by *Lotus corniculatus* L. until early July and *Erica cinerea* L. and *Trifolium repens* L. until the end of September.

Monitoring

Monitoring is an attempt to determine the presence and abundance of a species or an assemblage of species at a particular site over a period of several years. Hopefully changes in abundance of species can be related to some environmental factor. Alternatively, the effect of a management change can be studied by effects on a species or assemblage.

Waloff & Blackith (1962) monitored the growth and distribution of mounds of *Lasius flavus* (Fab.) over eight years. They were able to relate the death of colonies to changes in vegetation. Archer (1985, 2001) monitored the abundance of *Vespula germanica* (Fab.) and *V. vulgaris* (L.) for up to 27 years at various sites, finding in the first part of the study a two-year cycle of abundance driven by the behaviour of the social wasps themselves. During the second part of the study a dramatic decrease of abundance from the late 1970s to the early 1980s was found to be probably caused by the increased use of pesticides.

Surveys of single species are often concerned with finding the resource requirements for that species. Roberts & Else (2000) found that the mason wasp, *Pseudepipona herrichii*, needed a clay soil in which to make a nest, a nearby water resource to help in moulding the clay and caterpillars of the tortricid *Acleris hyemana* as a prey resource for its larval offspring. These caterpillars are found on the early and mid-succession stages of bell heather whose flowers were also used as a nectar resource by the adult wasps. This discovery of the prey resource has implication for the management of bell heather to maintain continuously the presence of early and mid-succession stages.

Archer (1990) reported on an assemblage of solitary wasp and bee species found in a suburban garden over a 12 year period which has now been extended to 27 years. During this time there has been an overall decrease in the abundance of all species. Dividing the species assemblage into three groups, spring and summer bee and wasp

species, the decrease in abundance was mainly due to the loss of summer bee abundance. The reasons for this decrease have yet to be investigated.

A recent management change at Shotover Hill, Oxford successfully provided additional nesting sites for subterranean nesters. Four shallow bays were excavated, providing a bare sandy surface with the scraped material piled up to give a vertical bank of about 30cm in height. The scrapes were rapidly colonised by 46 solitary wasp and bee species with their attendant 21 species of parasites (Conservation Management Advice, British Wildlife, 2005).

The methods that can be used to carry out monitoring are very varied. (i) Counting individuals or their artefacts: Sudd *et al.*, (1977) counted mounds of the wood ant, *Formica lugubris* Zetterstedt, and Waloff & Blackith the mounds of the yellow ant, *Lasius flavus*. Brian (1972), using mark-and-recapture, estimated the number of workers in colonies of *Myrmica sabuleti* Meinert. Archer (1984) counted the nest mounds of *Andrena clarkella*, finding 308 mounds in 360 sq.ft. (about 33.5 m^{-2}). Counts of individuals could also be made at flowers, e.g. *Colletes hederae*, or species making characteristic aerial nests, e.g. the use of the 'cigar galls' of *Lipara lucens* Meig. by *Passaloecus clypealis* and *Hylaeus pectoralis*. Walking a predetermined route under specified environmental conditions could be used to monitor bumblebees. (ii) Trapping techniques: Archer (1980, 1985, 1990, 2001) used Malaise, suction and baited traps to monitor social wasp abundance. Free & Williams (1970) explored the use of aerial artificial nests for *Osmia rufa* with success and also were able to study, from the pollen brought back to the nest sites, the flowers that had been visited. Corbet & Backhouse (1975) used beetle holes in pine boards to study the habits of three species of *Passaloecus* and Danks (1971a, 1971b) used dead bramble stems to study several solitary wasp and bee species but especially *Pemphredon lethifera* (Shuckard) and *Hylaeus brevicornis* Nylander.

Good and bad management of habitats for aculeate species

It is possible to give much general advice on good and bad practice of managing habitats for aculeates although little information is available of the consequences of good and bad management (Falk, 1991; Fry & Lonsdale, 1991; Kirby, 1992; Sutherland & Hill, 1995).

In general terms, habitats such as coastal sand dunes, salt marshes and maritime cliff and slopes should be maintained in their natural unimproved state, only using low-level grazing where necessary. Traditional management of grasslands and heathlands should be maintained. Grasslands should only be subject to low-level grazing to keep the habitat open and maintain large flower-rich areas. Traditional rotational burning of heathlands should be continued and to avoid summer fires, fire-breaks should be maintained. Generally on open habitats management activities should be taken to control scrub encroachment and woodland succession. The public use of habitats should be monitored and controlled if necessary. On lowland heathlands horse riding is usually restricted to bridleways and motorcycle activity banned. On coastal sand dunes the public may be controlled by the use of boardwalks and fencing. Traditional management of hedgerows should be continued with layering and keeping the bottoms fully exposed to the sun. The water levels of wet habitats, such as reed beds, fens and lowland raised bogs, should be maintained at a high stable level. Flower-rich grasslands should be maintained next to coastal shingle habitat.

Some other good management practices are the maintenance or creation of bare patches of soil either on the flat or as slopes and banks and keeping the areas around

such bare patches open by preventing vegetation growth. Dead wood in sunny situations should be retained for aerial nesters as well as patches of vegetation with dead pithy stems such as *Rubus* and *Rosa*. Patches of coarse vegetation, including taller grasses, should be retained in drier areas so that leaf litter layer accumulates.

Bad management is usually the cause of loss of habitat, removal of aculeate resources or adverse general public activities. Quarrying, afforestation, particularly coniferous afforestation, and urban and industrial building developments result in habitat loss on a large scale. Agricultural intensification, including the use of fertilizer and pesticides, improvement of drainage and hedgerow removal, has a severe impact on habitats. Sea defences can lead to the loss of coastal sand dunes and saltmarshes and stabilization of maritime cliffs and slopes prevents the natural regeneration of unstable surfaces. Some of these changes increase the level of environmental pollution. Neglect of habitats can be treated as bad management where it results in scrub encroachment and woodland succession so that open habitat is lost. Cleaning up a habitat, by removing dead wood and dead woody stems destroys aerial nesting sites. Public activities can lead to summer fires, erosion of soil by excessive disturbance by horse-riding, motorcycling or walking and bank erosion by wave action from boats.

When the specific requirements of a species are known then these resources can be provided or maintained. Pollen resources can be provided for the oligolectic bees, *Bryonia dioica* for *Andrena florea*, *Salix repens* for *Colletes cunicularis* and *Scabiosa columbaria* L. with *Knautia arvensis* (L.) for *Andrena hattorfiana* (Fab.). *Macropis europaea* requires *Lysimachia vulgaris* for pollen and nectar resources. *Populus* and *Salix* provide the prey needed by *Symmorphus connexus* (Curtis) and *S. crassicornis*, the latter being the host for *Chrysis fulgida*. *Argogorytes fargeii* (Shuckard) requires herb-rich areas with tall grasses from which it obtains prey for its offspring. The resource requirements of a species may seem, at times, to be in conflict with the management of a Priority Habitat. The Priority species, *Chrysis fulgida*, found on Lowland Heaths, via the food resource need of its host, requires the presence of *Populus* and *Salix*. *Populus* and *Salix* may not be regarded as a component of Lowland Heaths and be removed which could lead to the loss of *C. fulgida*. This example emphasizes the need to determine the resource needs of High Quality Species (Archer, 2005).

Conclusions

The study of British aculeate species which started in the nineteenth century has continued to the present resulting in ever expanding information on the habits and habitat associations of species. A relatively recent development has been a concern for aculeate conservation particularly with the discovery that nearly half of the species are at risk, or could be at risk, of local or total extinction. This concern has resulted in the need to give each species a quality status with the requirement to keep these statuses up-to-date by field-work, literature searches and the study of museum specimens.

The species of most conservation concern, here called High Quality species, can usually be associated with Priority Habitats, but few of these species are indicators of particular Priority Habitats. It would seem that that the resource needs of most aculeate species can be found in a range of open habitats. As such, it is necessary first to define the resource needs of a species before attempting to associate a species with a Priority or Broad Habitat.

The non-parasitic solitary wasps are characteristically associated with aerial-nesting sites and summer adult activity while, in contrast, the non-parasitic solitary bees are characteristically associated with subterranean-nesting sites and spring, summer and autumn adult activity. These differences may be linked to the solitary wasps' greater dependence on warmer weather conditions. The generally larger body size of solitary bees compared with solitary wasps may enable the solitary bees more easily to maintain the body temperature necessary for activity in cooler conditions.

The monitoring and habitat management for aculeate species would seem to be in its infancy. Research in these areas can bring benefit to aculeate populations as shown at Shotover Hill, Oxford. Research needs to investigate the resource needs of each species before applying beneficial habitat management changes. Such information may also allow a balance to be obtained between the needs of species and habitat conservation.

Acknowledgment and caution statement

The author is grateful for the help of D. Baldock who made useful suggestions on reading this paper. He informs me that *Crossocerus congener* should now be considered a resident species as it has been found on six sites in Middlesex and Hertfordshire. Since species status and their habitats may change with new information on distribution, the data in this paper are only a snapshot of the current situation as known by the author.

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SHORT COMMUNICATION

Some records of *Pteromalus leucanthemi* Janzon (Hymenoptera: Pteromalidae) from Kent. – On 21.vi.2004 I collected some flowerheads of *Leucanthemum vulgare* Lam. from Kemsing, Kent (TQ5559). Further collections were made on 1.vii.2004 from Shorne (TQ6873) and Higham (TQ7074). Many of the flowerheads were infested with larvae or pupae of *Tephritis neesii* (Meigen) (Diptera: Tephritidae). The flowerheads were placed in a well-ventilated and shaded garden shed. Imagines of *T. neesii* emerged between 30.vi.–3.vii.2004. From the collection made at Kemsing one male *Pteromalus leucanthemi* Janzon emerged on 30.vi.2004, one male and one female on 10.vii.2004 and three females emerged between 13.vii–15.vii.2004. From the collection made at Shorne one male *P. leucanthemi* emerged 5.vii.2004 and from those collected at Higham one male emerged 15.vii.2004.

Pteromalus leucanthemi is known as a primary parasitoid of *T. neesii* and was first recorded in Britain from material collected from Egham, Surrey in 2001 by Polaszek, Aplin, Brown and Gange (2004, *British Journal of Entomology and Natural History*, **17**: 45–49).

The specimens of *P. leucanthemi* have been deposited in the collections of R.R. Askew, whom I thank for their identification.–M.T. Jennings, 206 Lower Higham Road, Gravesend, Kent, DA12 2NN.